

CLAIMS

We claim:

1. A packaging system for electronic circuitry, wherein the electronic circuitry is disposed on a substrate, the packaging system comprising in combination:

5 an inner housing surrounding the substrate;

 an outer housing surrounding the inner housing and the substrate; and

 a gap positioned between the inner and outer housings, the gap filled with insulating media, whereby when the packaging system experiences short term exposure to a high temperature, the combination of the inner housing, the outer housing, and the
10 gap allow the electronic circuitry to maintain operability.

2. The system recited in claim 1, wherein the insulating media is a fluid.

3. The system recited in claim 2, wherein the fluid is air.

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4. The system recited in claim 1, wherein the substrate having the electronic circuitry disposed thereon comprises a substrate selected from the group of substrates consisting of a silicon-based substrate, a ceramic-based substrate, and a circuit-board-based substrate.

20 5. The system recited in claim 1, wherein the electronic circuitry comprises sensing electronics.

6. The system recited in claim 5, wherein the sensing electronics comprises a proximity sensor.

7. The system recited in claim 6, wherein the proximity sensor comprises a sensing element selected from the group consisting of a hall-effect sensing element, a magnetoresistive-sensing element, a potentiometric-sensing element, and an ultrasound-sensing element.

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8. The system recited in claim 1, wherein the inner housing is fabricated from a material having low thermal conductivity.

9. The system recited in claim 1, wherein the inner housing is fabricated from a material selected from the group consisting of plastic, ceramic, and metallic materials.

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10. The system recited in claim 1, wherein the outer housing is fabricated from a material having high thermal conductivity.

11. The system recited in claim 1, wherein the outer housing is fabricated from a material selected from the group consisting of steel, plastic, and ceramic materials.

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12. The system recited in claim 1, wherein the gap has a first thickness if the inner housing is fabricated from a material having a low conductivity and the outer housing is fabricated from a material having a high thermal conductivity, wherein the gap has a second thickness if the inner and outer housings are fabricated from a material having a low conductivity, and wherein the first thickness is greater than the second thickness.

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13. The system recited in claim 1, wherein the high temperature comprises a temperature of up to about 425 degrees Celsius.

14. The system recited in claim 1, wherein the short-term exposure comprises a
5 period up to about 15 seconds.

15. The system recited in claim 1, wherein the electronic circuitry maintains operability during and after the short-term exposure to a high temperature.

10 16. The system recited in claim 1, further comprising a second gap positioned between the inner housing and the substrate, the second gap filled with insulating media, wherein the second gap provides an additional insulating layer.

17. A packaging system for electronic circuitry, wherein the electronic circuitry is
15 disposed on a substrate, the packaging system comprising in combination:

an inner housing fabricated from material having low thermal conductivity, the inner housing defining a first cavity for accepting the substrate, the inner housing including an outer surface having at least one protrusion extending away from the outer surface;

20 an outer housing defining a second cavity for accepting the inner housing and substrate, the second cavity including an inner surface for contacting the at least one protrusion extending from the outer surface of the inner housing; and

a gap positioned between the outer surface of the inner housing and the inner surface of the outer housing, the gap filled with an insulating media, whereby when the packaging system experiences short term exposure to a high temperature, the combination of the inner housing, the outer housing, and the gap allow the electronic circuitry to maintain operability.

18. The system recited in claim 17, wherein

the inner housing is substantially cylindrical and has distal and proximate ends, the proximate end having an opening for the first cavity,

at least one protrusion from the outer surface of the inner housing defines (i) at least one first pedestal located on the distal end, (ii) a plurality of second pedestals located axially on the outer surface of the inner housing close to the distal end, and (iii) at least one ring located radially on the outer surface of the inner housing close to the proximate end,

the inner surface of the second cavity of the outer housing defines a cylindrical portion having distal and proximate ends, the proximate end having an opening for the second cavity, wherein when the inner housing is inserted in the outer housing, (i) at least one first pedestal contacts the distal end of the second cavity, (ii) the plurality of second pedestals contact the inner surface of the second cavity, and (iii) the at least one ring contacts the inner surface of the second cavity, and

the gap filled with insulating media defines a region between the outer surface of the inner housing and the inner surface of the outer housing when the inner housing is inserted in the outer housing.

19. The system recited in claim 18, wherein the substrate has distal and proximate ends, wherein when the substrate is accepted into the first cavity, the distal end of the substrate is close to the distal end of the first cavity and the proximate end of the substrate is close to the proximate end of the first cavity, and wherein the electronic circuitry comprises sensing electronics having a termination cable for coupling the sensing electronics to an external device, the termination cable protruding from the proximate end of the first cavity when the substrate is accepted into the first cavity.

20. The system recited in claim 19, further comprising at least one seal for sealing (i) the substrate within the first cavity, and (ii) the proximate ends of the inner and outer housings to each other, and wherein the termination cable passes through the seal.

21. The system recited in claim 17, further comprising a second gap positioned between the first cavity and the substrate, the second gap filled with insulating media, and the second gap providing an additional insulating layer.

22. The system recited in claim 21, further comprising an electromagnetic interference shield positioned between the outer surface of the inner housing and the substrate, the electromagnetic interference shield surrounding at least a portion of the substrate.

23. The system recited in claim 17, further comprising an electromagnetic interference shield positioned between the outer surface of the inner housing and the substrate, the electromagnetic interference shield surrounding at least a portion of the substrate.

5 24. A kit comprising:
the packaging system for electronic circuitry of claim 21, and
mounting hardware.

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